

# The status of generic revision in the African Vernonieae (Asteraceae)

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## Abstract

The tribe Vernonieae is reviewed for Africa and found to consist of 35 genera and 299 species. There is no doubt that more new genera or resurrected genera will be established for the tribe in the Eastern Hemisphere. About eleven subtribes have been established for Neotropical Vernonieae and three subtribes for Paleotropical Vernonieae. There are 10 species and 3 infraspecific taxa which are new combinations in this study. They are found in the genera *Orbivestus* (3 spp.), *Vernoniastrum* (4 spp.), *Linzia* (2 spp., 1 subsp., 1 var.), *Gymnanthemum* (1 sp., 1 var.).

The recent segregation from *Vernonia* of new genera in each of the two Hemispheres has given a great support for the different phyletic lines that have been proposed for the genus *Vernonia* in the Old World and the New World. The remaining *Vernonia* elements in Africa that have not been placed in any new or elevated genera have been estimated to be about 59 taxa.

## Introduction

The tribe Vernonieae is abundantly represented in the New World, particularly in Brazil where the diversity of genera and species is remarkable. In the Old World, numerous species are found in Africa, a secondary centre of distribution, and Madagascar, Southern Asia, and the Malay Archipelago (JONES 1977). In 1977 about 70 genera and 1,456 species were recognized, while 98 genera and 1,300 species were reported in 1994 for the tribe (TURNER 1977, BREMER 1994, NORDENSTAM 1998, ISAWUMI 1996a). However, ROBINSON (1996) recognized 111 genera worldwide with the expectation of a few further additions in the Western Hemisphere. More recently ROBINSON (2007) recognized 118 genera disposed in 15 subtribes. There is no doubt that more new subtribes and genera or resurrected genera will be established for the tribe especially in the Eastern Hemisphere (ISAWUMI 1999).

ADAMS (1963) reported ten genera including *Vernonia* SCHREB. for the tribe in West Africa, whereas JEFFREY (1988) recognized 13 genera in East Africa. However, ISAWUMI (1999) recognized 15 genera for the tribe in West Africa including *Vernonia*, *Baccharoides* MOENCH and *Cyanthillium* BLUME.

ROBINSON (1999, 2007) has established three subtribes for the Eastern Hemisphere Vernoniae based upon the reference works of many authors. He pointed out that the works of KIRKMAN (1981), POPE (1983), KOYAMA (1984), ISAWUMI (1993, 1995c), and ISAWUMI et al. (1996) have added important information.

It has been generally agreed by authors that there are some basic differences between the Vernoniae in the Eastern and Western Hemispheres (JONES 1977, 1981, JEFFREY 1988, ISAWUMI 1993, 1995c, ROBINSON 1999). The Hemispheric trends noted by JONES (1977) are in chromosome numbers and chemistry. The Western Hemisphere species usually have a chromosome number of  $n = 17$ , and the Eastern Hemisphere species have mostly  $n = 9$  or  $10$ . ROBINSON & KAHN (1986) and ISAWUMI et al. (1996) briefly noted the apparent restriction of glandular dots on the anthers and their appendages to New World members of the Vernoniae. ROBINSON (1999) noted the presence of elongate raphids mostly in the Eastern Hemisphere species while characteristically subquadrate or short raphids are found in the Western Hemisphere Vernoniae. BOHLMANN & JAKUPOVIC (1990) found the distinctive 5-alkyl coumarins only in Eastern Hemisphere genera and species, taxa that were all placed in the new subtribe Erlangeinae by ROBINSON (1999).

In earlier times the tribe has been the dumping ground for poorly known taxa of the Compositae. Such taxa included *Liabum* ADANS., *Pseudostiffia* H. ROB., *Moquinia* DC., *Hoplophyllum* DC., and *Corymbium* L. *Liabum* and its relatives have now been recognized as members of the distinct tribe Liabeae (CASS.) RYDB. (RYDBERG 1927, ROBINSON & BRETTELL 1973a, b, 1974, NORDENSTAM 1977, BREMER 1994). The two genera *Pseudostiffia* and *Moquinia* have been transferred to the new tribe Moquinieae by ROBINSON (1994). KARIS (1992) has shown that the South African *Hoplophyllum* is related to *Eremothamnus* HOFFM. in the tribe Arctoteae, although these two genera were placed by ROBINSON (1994) in the tribe Eremothamneae. The genus *Corymbium* of South Africa (revised by WEITZ 1989) has also been regarded as not belonging to Vernoniae on the basis of chemistry (BOHLMANN & JAKUPOVIC 1990). As a result of molecular studies by PANERO & FUNK (2002), *Corymbium* was placed in a new subfamily Corymbioideae and a new tribe Corymbieae. Some elements added to the tribe Vernoniae or confirmed as members of the tribe are *Stokesia* L'HÉR. and *Trichospira* KUNTH (ROBINSON 1996). The most interesting additions to the tribe were the various synonyms of *Distephanus* CASS. (*Gongrothamnus* STEETZ, *Newtonia* HOFFM. and *Antunesia* HOFFM.) that were rather consistently placed in the Senecioneae in the traditional

systems of classification (BENTHAM 1873, HOFFMANN 1893) because of their yellow florets and trinervate leaves. Their placement in the Vernoniaeae was established by ROBINSON & KAHN (1986) and others.

### Subtribal classification of the African Vernoniaeae

The new and re-established subtribes proposed by ROBINSON et al. (1980) and ROBINSON (1996) comprise primarily Western Hemisphere Vernoniaeae. In order to rectify the situation, ROBINSON (1999) named three subtribes for the Eastern Hemisphere species, and more subtribes can be expected to be recognized in both hemispheres. The two subtribes Vernoniinae and Elephantopinae are also represented in the Eastern Hemisphere (cf. below).

**Erlangeinae** H. ROB. Type: *Erlangea plumosa* SCH. BIP., Flora 36: 34. 1853.

The name, according to ROBINSON (1999), is chosen to conform with the already established term "Erlangeoid" (POPE 1983). Characteristically, the subtribe includes Vernoniaeae with mostly triporate pollen and 5-alkyl coumarins (BOHLMANN & JAKUPOVIC 1990). It also includes genera with 4–5 angled achenes and a herbaceous habit (with few exceptions having 10-ribbed achenes and a woody habit). All the included genera have acicular sweeping hairs of the style. Chromosome number  $n = 9, 10, 20$ . The genera included are the New World *Acilepidopsis* H. ROB. (1989), *Mesanthophora* H. ROB. (1992) and *Telmatophila* MART. ex BAK. (1873), and the Old World genera *Acilepis* D. DON, *Ageratinastrum* MATTF., *Ambassa* STEETZ, *Bechium* DC., *Bothriocline* OLIV. ex BENTH., *Brachythrix* WILD & POPE, *Cyanthillium* BLUME, *Decastylocarpus* HUMBERT, *Dewildemanina* O. HOFFM., *Diaphractanthus* HUMBERT, *Erlangea* SCH. BIP., *Ethulia* L.F., *Gutenbergia* SCH. BIP. ex WALP., *Herderia* CASS., *Hystrichophora* MATTF., *Iodocephalus* THOREL ex GAGNEP., *Kinghamia* C. JEFFREY, *Lamprachaenium* BENTH., *Msuata* O. HOFFM., *Muschleria* S. MOORE, *Omphalopappus* O. HOFFM., *Paurolepis* S. MOORE, *Phyllocephalum* BLUME, *Polydora* FENZL, *Rastrophyllum* WILD & G. V. POPE, and seven genera newly named or elevated by ROBINSON (1992, 1999), viz., *Cabobanthus* H. ROB., *Hilliardiella* H. ROB., *Koyamasia* H. ROB., *Mesanthophora* H. ROB., *Orbivestus* (S. B. JONES) H. ROB., *Oocephala* (S. B. JONES) H. ROB., *Vernoniastrum* H. ROB.

**Centrapalinae** H. ROB. Type: *Centrapalus galamensis* CASS., Dict. Sci. Nat. ed. 2, 7: 382. 1817.

The genera of the subtribe are herbaceous or weakly shrubby, and the sweeping hairs of the styles are acicular. The sesquiterpene constituents of the species include elemanolides (BOHLMANN & JAKUPOVIC 1990). The subtribe includes elements with the distinctive *Linzia*-type pollen (JEFFREY 1988) such as *Linzia*

and *Aedesia*, and one element with polar lacunae on its pollen grains and a lack of basal styler nodes, like *Baccharoides* (ISAWUMI 1993, ISAWUMI et al. 1996). Chromosome number  $n = 9, 10$ . The subtribe is typified by *Centrapalus* CASS. and also includes *Adenoon* DALZ., *Aedesia* O. HOFFM., *Baccharoides* MOENCH, *Camchaya* GAGNEP., *Lachnorhiza* A. RICH., *Linzia* SCH. BIP. ex WALP., *Neurolakis* MATTF. and *Pleurocarpaea* BENTH.

**Gymnantheminae** H. ROB. Type: *Gymnanthemum cupulare* CASS., Bull. Soc. Philom. Paris 1817: 10 . 1817. [= *G. coloratum* (WILLD.) H. ROB. & B. KAHN].

The subtribe includes all of the true large shrub and tree Vernoniaeae in the Eastern Hemisphere. The sweeping hairs of the styles often have rather blunt tips. Inner involucre bracts are persistent or deciduous. Stellate hairs are lacking. Chromosome number is  $n = 9, 10, 15, 20$ . The subtribe has these genera: *Gymnanthemum* CASS., *Distephanus* CASS., *Centauroopsis* BOJ. in DC., *Oliganthes* CASS., and three genera named or elevated by ROBINSON (1999), viz., *Brenandendron* H. ROB., *Lampropappus* (O. HOFFM.) H. ROB. and *Myanmaria* H. ROB. In addition there is one New World genus, *Hesperomania* A. GRAY, which is endemic to Hawaii (ROBINSON 2007).

### Generic classification of the African Vernoniaeae

The first comprehensive work on Vernoniaeae in West Africa is the key to the genera and species of the tribe by ADAMS (1963). He reported ten genera including *Vernonia* for the tribe in West Africa, whereas JEFFREY (1988) recognized 13 genera and 126 species in East Africa. ISAWUMI (1999) recognized 15 genera in West Africa including the new resurrected genera *Baccharoides* and *Cyanthillium*. OLIVER & HIERN (1877) reported 78 species for Africa, and JONES (1977) recorded c. 200 for the continent. ADAMS (1963) reported 60 species for West Africa and this number was reduced to 42 by ISAWUMI (1996a,b). In the present report about 59 *Vernonia* species remain untransferred to new, resurrected or elevated genera. Also 35 genera and 299 species are presently recognized for Africa in the tribe.

**Table 1. List of accepted genera in the tribe Vernoniae in Africa with approximate number of species, general distribution, habit and chromosome number.**

No.	Genera	Number of Species	Distribution	Habit	Chromosome number
1.	<i>Vernonia</i> SCHREB.	59	West & East Africa, Southern Africa	Annual or Perennial Herb	n = 9 or 10
2.	<i>Baccharoides</i> MOENCH	25	West, East & Central Africa, South Africa	Shrub	n = 10
3.	<i>Cyanthillium</i> BLUME	7	West Africa, East Africa, South Africa, Madagascar	Herb	n = 9
4.	<i>Elephantopus</i> L.	5	West Tropical Africa, East & Central Africa, Senegal, Macias, Nguema (Fernando Poo)	Herb	
5.	<i>Pseudelephantopus</i> ROHR	1	Introduced to East & West Tropical Africa (Native of Neotropics)	Herb	
6.	<i>Sparganophoros</i> VAILL.	1	West, East & Central Africa, Madagascar	Herb	
7.	<i>Ethulia</i> L.f	13	West, East & Central Africa, South Africa	Annual or Perennial Herb	n = 10
8.	<i>Adesia</i> O. HOFFM.	1	Tanzania, West & Central Tropical Africa	Perennial Herb	n = 10
9.	<i>Herderia</i> CASS.	1	West Africa	Annual	
10.	<i>Erlangea</i> SCH. BIP.	6	Guinea, Sierra Leone, Tanzania, Ethiopia, Somalia	Annual or Perennial Herb	n = 10

11.	<i>Bothriocline</i> OLIV. ex BENTH.	31	West, East & Central Africa, South Africa, Madagascar	Annual or Perennial Herb	n = 9, 10
12.	<i>Centratherum</i> CASS.	1	West Africa	Annual Herb	n = 10
13.	<i>Gutenbergia</i> SCH. BIP.	13	West, East & Central Tropical Africa, Southern Africa	Annual or Perennial Herb	
14.	<i>Kinghamia</i> C. JEFFREY	5	West Tropical Africa, Zaire	Herb	
15.	<i>Hystrichophora</i> MATTF.	1	Tanzania	Herb	
16.	<i>Rastrophyllum</i> WILD & POPE	1	East Tropical Africa	Annual	
17.	<i>Dewildemanina</i> O. HOFFM.	2	East Tropical Africa	Perennial	
18.	<i>Distephanus</i> CASS.	25	South & East Africa, Madagascar	Small shrubs or vines	
19.	<i>Ageratinastrum</i> MATTF.	1	Tanzania, Malawi, Zambia	Perennial	
20.	<i>Brachythrix</i> WILD & POPE	3	Tanzania, Mozambique	Perennial	
21.	<i>Msuata</i> O. HOFFM.	1	Tropical Africa	Shrub	
22.	<i>Stephanolepis</i> S. MOORE	1	Tropical Africa	Perennial	
23.	<i>Bechium</i> DC.	2	Madagascar	Herb	
24.	<i>Cabobanthus</i> H. ROB.	2	Central Africa	Herb	n = 9
25.	<i>Hilliardiella</i> H. ROB.	8	South Africa, West & Central Tropical Africa	Herb	n = 9, 10
26.	<i>Orbivestus</i> (S.B. JONES) H. ROB.	7	West, Central & Southern Africa	Undershrub	n = 9, 20
27.	<i>Oocephala</i> (S. B. JONES) H. ROB.	2	West, East & Central Africa	Shrub	

28.	<i>Polydora</i> FENZL	8	East, West & Central Africa	Annual Herb	n = 9
29.	<i>Vernoniastrum</i> H. ROB.	12	East, West, Central & Southern Africa	Herb	n = 10
30.	<i>Centrapalus</i> CASS.	8	Southern, West, East, Central & North Africa	Annual or Perennial Herb	
31.	<i>Linzia</i> SCH. BIP. ex WALP.	9	West, East, Central & South Africa, Madagascar	Herb	n = 10
32.	<i>Gymnanthemum</i> CASS.	30	South, West, East, Central & North Africa, Africa to Sudan, Madagascar	Shrubs or Trees	n = 10, 20
33.	<i>Brenandendron</i> H. ROB.	3	West, East & Central Africa	Shrub	n = 9
34.	<i>Lampropappus</i> (O. HOFFM.) H. ROB.	3	East & Central Africa	Subshrub	
35.	<i>Manyonia</i> H. ROB.	1	Tanzania	Perennial Herb	

In order to redefine the Paletropical members of *Vernonia*, ROBINSON & KAHN (1986), ROBINSON (1990a), ISAWUMI (1993, 1995a,b), ISAWUMI et al. (1996) transferred some *Vernonia* species to the three resurrected genera *Distephanus*, *Baccharoides* and *Cyanthillium*.

ROBINSON & KAHN (1986) separated *Distephanus* from *Vernonia* and recognized 26 species in the genus. The genus is distinct from the genus *Vernonia* because the species have yellow flowers, with broad sclerified basal appendages on the anther thecae, apical appendages without glands and style base with large abruptly broadened node. Pollen in many species are "Type A" (KEELEY & JONES 1979), with continuous intercolpar perforated tectum and reticulately arranged spines. Some Madagascar species have irregularly lophate pollen grains with perforated tectum restricted to lower sides and bases of crests, with distinct colpi intruded upon by short alternating spurs of reticulate tectum (ROBINSON & KAHN 1986).

### ***Baccharoides* MOENCH**

ROBINSON (1990a) resurrected the genus *Baccharoides* and transferred three species of *Vernonia* to the genus. ISAWUMI (1993) transferred twelve species of *Vernonia* to the genus *Baccharoides* on the basis of the style base being surrounded by the



nectary and inner involucrel bracts with expanded foliose appendages, which may be white or variously coloured. ISAWUMI et al. (1996) recognized 25 species and 26 infraspecific taxa in the genus *Baccharoides* on the basis of morphological characters such as the endothelial tissue being “polarized” as described by DORMER (1962). In the pollen the oral (poral) lacunae (EL-GHAZALY 1980) are joined with the aboral lacunae by broad interlacunar gaps, thus producing the three long colpi running nearly from pole to pole. Each colpus encloses a central compound os with two perpendicular ora and is bounded on either side by the paraoral ridges (ISAWUMI et al. 1996). This type of aperture with two ora is referred to as colporate instead of colporate. The columellae in the genus *Baccharoides* are stout, branched distally and anastomose within the ridges (ISAWUMI 1995a, ISAWUMI et al. 1996). In this group the oral lacunae are more or less indistinct, and therefore markedly different from the ones found in other groups of *Vernonia* s.l. In addition, the colpus is long and the ora are not in a well defined constriction.

JEFFREY (1988) has pointed out that the *Baccharoides* group is “one of the most distinct Old World taxa of Vernoneae and the case for its recognition at generic rank is undeniable”. I strongly attest to this fact because it was formerly a distinct entity as *Vernonia* section *Stengelia*. The diagnostic characteristics are remarkably different from those of *Vernonia* s.l. So, the criticism of AYODELE & OOLORODE (2005) of the separation of *Baccharoides* from *Vernonia* s.l. by ROBINSON (1990a) and ISAWUMI et al. (1996) could not be sustained mainly on adaptation strategies alone because the group was resurrected as a genus based on many characters. Such re-classification is necessary so that the genus *Vernonia* may gradually reduce in heterogeneity and size and eventually become a monophyletic genus. As a result, many genera are being separated from *Vernonia* s.l. in the Neotropical and Paleotropical regions of the World as evidenced in the works of ROBINSON (1996, 1999, 2007).

### *Cyanthillium* BLUME

ROBINSON (1990a) transferred three species of *Vernonia* to the resurrected genus *Cyanthillium* on the basis of the pollen characteristics, which are remarkably different from those of the genus *Vernonia* and other Vernoneae in that the colpus is not evident and the grains have a polar areole surrounded by a tier of five to seven areoles. On the basis of floral microcharacters ISAWUMI (1995b) accepted the establishment of the genus before transferring four varieties of *C. cinereum* to the genus. The genus, in contrast to the genus *Baccharoides* and the genus *Vernonia* s.l., has no colpus and the endothelial tissue is intermediate unlike the one in *Baccharoides* which is distinctly polarized (ISAWUMI 1995a, ISAWUMI et al. 1996). The filament collar in *Cyanthillium* is elongate and straight unlike the ones in *Baccharoides* which are more or less shortly cylindrical and sometimes somewhat dilated distally (ISAWUMI 1995a).



**Genera of African Vernoniae Subtribe Erlangeinae H. ROB. Elevated or Named by ROBINSON (1999) and Some New Combinations**

*Bechium* DC., Prodr. 5: 70. 1836. Type: *Bechium scapiforme* DC.

There are two species in the genus and both occur in Madagascar.

*Cabobanthus* H. ROB. Type: *Vernonia polysphaera* BAKER.

There are two species and they occur in Zambia, Tanzania and Congo.

*Cyanthillium* BLUME, Bijdr. Fl. Ned. Ind. 889. 1826. Type: *Cyanthillium villosum* BLUME.

Seven species are presently placed in the genus and they occur in Africa and Madagascar.

*Hilliardiella* H. ROB. Type: *Vernonia pinifolia* LESS.

The genus with eight species is closely related to *Cyanthillium*, but it differs in its more perennial habit, the non-lophate pollen and the presence of T-shaped hairs of the corolla [except *Cyanthillium cinereum* (L.) H. ROB. var. *ugandense* (C. JEFFREY) ISAWUMI which also has T-shaped trichomes on its corolla (ISAWUMI 1995b)]. Chromosome number  $n = 9, 10$  (JONES 1982). Distribution: South Africa, Congo, Tanzania, Malawi, Mozambique, Zambia, Ethiopia, West and Central Tropical Africa.

*Orbivestus* (S. B. JONES) H. ROB. Type: *Vernonia karaguensis* OLIV. & HIERN.

The genus is distinct from the related *Cyanthillium* by the more shrubby habit, the lack of simple hairs on the corolla lobes, and non-lophate pollen (ROBINSON 1999). Chromosome number  $n = 9, 20$  (JONES 1982, MANGENOT & MANGENOT 1962, MEHRA et al. 1965). Distribution: Angola, Botswana, Kenya, Somalia, Sudan, Mozambique, Nigeria and West Africa.

Four species were placed in the genus by ROBINSON (1999). Three further species are placed in the genus in this study. They are the following:

***Orbivestus blumeoides* (HOOK. f.) ISAWUMI, comb. nov.**

Basionym: *Vernonia blumeoides* HOOK. f. in J. Linn. Soc. Bot. 7: 198. 1864. Type: Cameroon, MANN 1241. 1921 (syntype K).

An erect little-branched undershrub. Leaves pubescent with T-shaped trichomes. Capitula campanulate; phyllaries 4-seriate; corolla lobes and tubes with capitate and stipitate glands of various shapes and sizes. Anther calcarate; apical anther appendage ovate-oblong; stylar ring (stylopodium) about 6 cells per row with annular thickenings on the walls. Achene 5-costate, with large carpopodium,

glabrous with idioblasts; pappus caducous, biseriate, outer elements shorter and broader than inner, barbellate setae, glabrous at the base.

Distribution: Nigeria, Cameroon.

***Orbivestus bamendae* (C. D. ADAMS) ISAWUMI, comb. nov.**

Basionym: *Vernonia bamendae* C. D. ADAMS in J. W. Afr. Sc. Assoc. 3: 116. 1957.

Type: Cameroon, MAITLAND 1514 (holotype K!).

A robust herb with broad sessile leaves. Leaves pubescent with T-shaped trichomes. Capitula campanulate; phyllaries 5–6-seriate; corolla lobes with capitate and stipitate glands. Anther calcarate; apical anther appendage spear-shaped, ovate-oblong; styler ring about 5 cells per row. Achene 4-costate with idioblasts, glabrescent with biseriate trichomes; carpodium moderately large; pappus biseriate, caducous, outer elements broader and shorter than inner, barbellate setae, glabrous at the base.

Distribution: Nigeria, Cameroon.

***Orbivestus albocinerascens* (C. JEFFREY) ISAWUMI, comb. nov.**

Basionym: *Vernonia albocinerascens* C. JEFFREY in Kew Bull. 42(2): 222. 1988.

Type: Uganda, Karamoja District, Mt. Moroto, southern foothills, TWEEDIE 2643 (holotype K). It is similar to *Orbivestus cinerascens* (SCH. BIP. in SCHWEINF.) H. ROB. as mentioned by ROBINSON (1999).

Distribution: Uganda, Kenya, Tanzania.

***Oocephala* (S. B. JONES) H. ROB. Type: *Vernonia oocephala* BAKER.**

Low much-branched shrubs to 1 m high, stems with weakly L-shaped simple hairs and with multiseptate simple hairs. Florets about 15 in a head. Anther bases rounded; apical anther appendages glabrous, with thin wall cells; style base with indistinct ring; style branches with acicular sweeping hairs. Achenes weakly 8-ribbed, idioblasts numerous, raphids narrowly elongate; pappus biseriate, outer shorter and broader, inner setiform, subplumose, glabrous near base.

Two species. Distribution: Burundi, Congo, Tanzania, Nigeria, Mozambique.

***Polydora* FENZL, Flora 27: 312. 1844. Type: *Polydora stoechadifolia* FENZL.**

Mostly annuals; stems with one-armed T-shaped hairs; anthers untailed, pollen triporate; chromosome number  $n = 9$  (JONES 1979, 1982).

The genus is credited with eight species (ROBINSON 1999). Distribution: Tanzania, Mozambique, Zambia, Zimbabwe, Congo, Malawi, Angola, Burundi, Botswana, Namibia, Transvaal, Sudan, Ethiopia, South Africa, West Africa to Nigeria.

*Vernoniastrum* H. ROB. Type: *Crystallopollen latifolium* STEETZ in PETERS.

The genus is closely related to *Polydora* FENZL, but differs by the perennial habit, the non T-shaped hairs, the tailed anther bases and the chromosome number of  $n = 10$ . The core element of the genus also has the idioblasts of the achene in distinct transverse bands.

The genus was credited with eight species by ROBINSON (1999). Distribution: Kenya, Tanzania, West Africa to Sudan, South to Angola, Congo, Mozambique, Zimbabwe, Zambia, Burundi, Ethiopia, Somalia, Malawi.

Four species are added here as new combinations:

***Vernoniastrum paraemulans* (C. JEFFREY) ISAWUMI, comb. nov.**

Basionym: *Vernonia paraemulans* C. JEFFREY in Kew Bull. 43(2): 246. 1988. Type: Tanzania. Iringa District, Iringa, MILNE-REDHEAD & TAYLOR 11150 (holotype K!).

It is similar to *Vernoniastrum aemulans* (VATKE) H. ROB. as implied by JEFFREY (l.c.) and mentioned by ROBINSON (1999). Distribution: Tanzania.

***Vernoniastrum migeodii* (S. MOORE) ISAWUMI, comb. nov.**

Basionym: *Vernonia migeodii* S. MOORE in J. Linn. Soc. Bot. 35: 319. 1902 Type: Nigeria, MIGEOD (holotype BM).

A perennial herb with sessile leaves. Leaves pubescent with flagelliform trichomes without T-shaped types. Corolla lobes with long uniseriate trichomes, glandular with capitate and biseriate glands. Apical anther appendage spear-shaped; style base peg-like. Achene inconspicuously 5-costate; pappus biseriate, outer elements scale-like and broader than inner, with barbellate setae.

Distribution: Nigeria, Benin, Ghana, Cameroon.

***Vernoniastrum klingii* (O. HOFFM. & MUSCHL.) ISAWUMI, comb. nov.**

Basionym: *Vernonia klingii* O. HOFFM. & MUSCHL. in Mem. Soc. Bot. Fr. 2, 8c: 112. 1910. Type: Guinee, CHEVALIER 15743 (syntype P), KLING 25 (syntype B), BUETTNER 9 (syntype K).

Plant perennial; capitula campanulate; phyllaries 4-seriate. Corolla turbinate; corolla lobes glandular with capitate glands, pubescent at tips without T-shaped hairs; stylar ring about 3 cells per row with thin cell walls. Achene 8-costate, glandular on the furrows. Pappus biseriate, outer elements shorter and broader than inner, barbellate setae.

Distribution: Guinea, Ghana, Sierra Leone, Benin, Cote d'Ivoire.

***Vernoniastrum camporum* (A. CHEV.) ISAWUMI, comb. nov.**

Basionym: *Vernonia camporum* A. CHEV. in Mem. Soc. Bot. Fr. 2, 8e: 259. 1917.  
Type: Guinee, CHEVALIER 20408 (holotype P).

Phyllaries 6–7-seriate. Corolla lobes with capitate glands. Styler ring about 4 cells per row. Achene 8-costate, with idioblasts, pubescent with biseriate trichomes. Pappus biseriate, outer elements shorter than inner ones, persistent with barbellate setae, glabrous at the base.

Distribution: Nigeria, Guinea, Sierra Leone, Cameroon, Ghana, Senegal.

**Resurrected and New Genera of African Vernonieae Subtribe  
Centrapalinae H. ROB. and Some New Combinations**

*Centrapalus* CASS., Bull. Soc. Philom. Paris 1817: 10. 1817. Type: *Centrapalus galamensis* CASS.

Annual or perennial, scapose or subscapose herbs; stem hairs simple, multiseptate; involucre hemispherical, bracts 125–150 in about 5–6 series, linear, green, often with small teeth on distal margin; corolla lobes sometimes fringed with long papillae; style base with broad node. Achenes weakly 10-costate, setuliferous; raphids narrowly oblong. Chromosome number  $n = 9$  (JONES 1974, 1979, 1982).

Nine species were placed in the genus by ROBINSON (1999). Distribution: Sierra Leone, Nigeria, Congo, South Africa, Angola, Zimbabwe, Sudan, Malawi, Tanzania, Zambia, Mozambique, Uganda, Ethiopia.

*Linzia* SCH. BIP. ex WALP. Rep.2: 948. 1843. Type: *Linzia vernonioides* SCH. BIP. ex WALP.

Seven species were credited to the genus by ROBINSON (1999). Distribution: Congo, Burundi, Kenya, Tanzania, Angola, Namibia, Mozambique, Swaziland, South Africa (Transvaal, Natal), Madagascar.

The following two species and two infraspecific taxa are new combinations :

***Linzia gerberiformis* (OLIV. & HIERN) H. ROB. subsp. *macrocyanus* (O. HOFFM.) ISAWUMI, comb. nov.**

Basionym: *Vernonia macrocyanus* O. HOFFM. in Bol. Soc. Brot. 13: 20. 1896.  
Type: Angola, Catumba, WELWITSCH 3883 (isotype BM!).

Syn.: *Vernonia gerberiformis* OLIV. & HIERN subsp. *macrocyanus* (O. HOFFM.) C. JEFFREY in Kew Bull. 43: 234. 1988.

ROBINSON (1999) regarded *V. macrocyanus* as a synonym of *Linzia gerberiformis*.

JEFFREY (1988) gave it subspecies status while ISAWUMI (1995c) maintained its species status. It is different from *Linzia gerberiformis* because subsp. *macrocyanus* has (a) appendage-like upper part of phyllary triangular-lanceolate, acuminate, (b) apical anther appendage about 0.6 mm long, ovate, (c) style branches slightly coiled with swollen shaft below, (d) style base without a ring, peg-like (ISAWUMI 1995c, Fig. 9).

The synonymy of *Linzia gerberiformis* subsp. *macrocyanus* is as cited by JEFFREY (1988) and ISAWUMI (1995c).

Distribution: Nigeria, Cameroon, Mali, East and South Africa, Angola.

***Linzia ituriensis* (MUSCHL.) H. ROB. var. *occidentalis* (C. D. ADAMS) ISAWUMI, comb. nov.**

Basionym: *Vernonia glabra* (STEETZ) VAIKKE var. *occidentalis* C. D. ADAMS in J. W. Afr. Sc. Assoc. 3, 1: 119. 1957. Type: Nigeria, ONOCHIE in FHI 34855 (holotype K).

Syn.: *Vernonia ituriensis* MUSCHL. var. *occidentalis* (C. D. ADAMS) C. JEFFREY in Kew Bull. 43: 231. 1988.

Phyllaries 6–7-seriate, pectinate-ciliate at margins, black at tips, shorter than those of *Linzia ituriensis* (MUSCHL.) H. ROB. Corolla 12–14 mm long; corolla lobes with unicellular trichomes sparsely concentrated at the tips and with long stipitate glands. Anther base weakly calcarate with blunt ends; apical anther appendage more or less elliptic with flat end and solid line in the middle. Style branches coiled; stylar ring with 2–3 cells per row. Pappus orange, biseriate, persistent, outer setae shorter and broader than inner, barbellate (see ISAWUMI 1995c, Fig. 13).

Distribution: Nigeria, Cameroon.

***Linzia nigritiana* (OLIV. & HIERN) ISAWUMI, comb. nov.**

Basionym: *Vernonia nigritiana* OLIV. & HIERN in Fl. Trop. Afr. 3: 288. 1877. Type: Nigeria, Abeokuta, IRVINE (syntype FHI!).

Perennial herb; phyllaries 6–8-seriate, lanceolate, pectinate-ciliate at tips. Corolla lobes funnel-shaped, apically sparsely stiffly hairy, with flagellate, unicellular and uniseriate trichomes. Anther basally shortly calcarate; apical anther appendage about 0.8 mm long, more or less triangular, glabrous; filament collar distinct with thickened cells at cross-walls. Style branches coiled; style base peg-like. Achenes turbinate, strongly 10-costate, hispid with biseriate hairs; carpodium rather large; pappus biseriate, persistent, orange, the outer shorter, of barbellate setae.

Distribution: Senegal, Gambia, Mali, Sierra Leone, Cote d'Ivoire, Ghana, Nigeria, Cameroon.

***Linzia purpurea* (SCH. BIP. ex WALP.) ISAWUMI, comb. nov.**

Basionym: *Vernonia purpurea* SCH. BIP. ex WALP. in Repert. Bot. Syst. 2: 946. 1843. Type: Ethiopia, SCHIMPER 1197 (holotype P!), Synonymy as cited by JEFFREY (1988) and ISAWUMI (1995c), plus *Centrapalus purpureus* (SCH. BIP. ex WALP.) H. ROB., Proc. Biol. Soc. Wash. 112(1): 236. 1999.

Perennial herbs; phyllaries 6–8-seriate, triangular-lanceolate, obscurely pectinate-ciliate at margins, arachnoid-pubescent, sharply apiculate, dark at tips. Corolla funnel-shaped; corolla lobes covered with capitate glands interspersed with unicellular trichomes, with some trichomes concentrated at the tips of the lobes. Anther basally calcarate; apical anther appendage ovate oblong; filament collar distinct with cells thickened on the walls; stylar ring about 2–4 cells per row. Achenes 10-costate, with numerous idioblasts, pilose with biseriate hairs; carpodium large; pappus biseriate, yellowish, of persistent barbellate setae.

Distribution: Senegal, Mali, Ghana, Nigeria, Cameroon, Guinea Bissau; East, Central and South Tropical Africa.

**Newly Resurrected or Described Genera of African Vernonieae Subtribe  
Gymnantheminae H. ROB. and Some New Combinations**

*Distephanus* CASS., Bull. Soc. Philom. Paris 1817: 151. 1817. Type: *Conyza populifolia* LAM. Synonymy as stated by ROBINSON & KAHN (1986).

ROBINSON & KAHN (1986) and ROBINSON (1999) transferred 27 species into the genus of which 25 species are in Madagascar and continental Africa, one in China and one in Yunnan.

*Gymnanthemum* CASS., Bull. Soc. Philom. Paris 1817: 10. 1817. Type: *G. cupulare* CASS. (= *Baccharis senegalensis* PERS. = *Gymnanthemum coloratum* (WILLD.) H. ROB. & B. KAHN). Synonymy as cited by ROBINSON (1999).

The genus is credited with 43 species by ROBINSON (1999) but 14 of them do not occur in Africa and Madagascar. In this paper one further species and one infraspecific taxon are recognized. So, 30 species and one infraspecific taxon are referred to the genus in Africa and Madagascar.

***Gymnanthemum auriculiferum* (HIERN) ISAWUMI, comb. nov.**

Basionym: *Vernonia auriculifera* HIERN in Cat. Welw. Afr. Pl. 1: 539. 1898. Type: Angola, WELWITSCH 3258 (syntypes BM, K, isotypes BR, K).



Synonymy as cited by JEFFREY (1988) and ISAWUMI (1995c).

Shrub. Capitula tubular and spindle-shaped with a single floret; phyllaries 6–7-seriate, slightly tomentose at the base of the outermost bracts with one short vein at the tips; outer ovate, hyaline-margined, acute, inner elliptic, apiculate, caducous. Corolla tubular; corolla lobes undulate at margin. Anther basally calcarate; apical anther appendage ovate oblong; filament collar distinct with cells thickened on the walls; stylar ring about 5 cells per row. Achene 10-costate, with idioblasts, pilose with biseriate hairs; pappus biseriate with the outer setae shorter, white, caducous, barbellate.

Distribution: Nigeria, Cameroon, East and Central Africa.

***Gymnanthemum theophrastifolium* (SCHWEINF. ex OLIV. & HIERN) H. ROB. var. *richardianum* (O. KUNTZE) ISAWUMI, comb. nov.**

Basionym: *Cacalia richardiana* O. KUNTZE in Revis. Gen. Pl. 2: 967. 1891. Type: Ethiopia, Gondar, DILLON (holotype P!).

Syn.: *Vernonia richardiana* (O. KUNTZE) P.-SERMOLLI in Webbia 7: 340. 1950, *V. theophrastifolia* SCHWEINF. ex OLIV. & HIERN var. *richardiana* (O. KUNTZE) ISAWUMI, in Advances in Comp. Syst. Kew p. 103. 1995. Other synonymy as cited by ISAWUMI (1995c) and ROBINSON (1999).

A shrub or a small tree. Capitula turbinate-campanulate, about 10-flowered; phyllaries 8-seriate, glabrous to tomentose at the base of the outermost bracts with the peduncle tomentose; outer ovate, obtuse, successively shorter; inner elliptic, acute, with broad hyaline margins, caducous. Corolla tubular, corolla lobes pubescent. Anther base shortly calcarate, apical anther appendage ovate. Stylar ring about 5 cells per row with the cells heavily sclerified. Achene with idioblasts, obscurely 8–10-costate, pilose with biseriate hairs; pappus biseriate, uniform, dense, of scabrid setae.

JEFFREY (1988) recorded this taxon as a synonym of *Vernonia theophrastifolia* and ROBINSON (1999) concurred with this view. ISAWUMI (1995c) regarded it as a variety of *V. theophrastifolia*. It is still recognized as a variety here because of the following differences:

- (a) It has simple and biseriate trichomes on the corolla lobes while the corolla lobes of *G. theophrastifolium* are glabrous.
- (b) It has broader hyaline margins on the phyllaries.
- (c) The head is 10-flowered while it is 8-flowered in *theophrastifolium*.
- (d) Corolla lobes in *richardianum* are pubescent with short simple trichomes while they are glabrous in *theophrastifolium*.



(e) The pappus is biseriate and uniform but in *theophrastifolium* the outer setae are shorter than the inner ones (see ISAWUMI 1995c, Fig. 24).

Distribution: Cameroon, Nigeria, Ghana, East Tropical Africa.

*Brenandendron* H. ROB. Type: *Vernonia titanophylla* BRENNAN.

ROBINSON (1999) pointed out that *Brenandendron* is closely related to *Gymnanthemum* but it differs by the distinctive frondiform inflorescence. He placed three species in the genus.

Distribution: Sierra Leone, Liberia, Guinea, Cameroon, Sudan, Central Tropical Africa.

*Lampropappus* (O. HOFFM.) H. ROB. Type: *Vernonia lampropappus* O. HOFFM.

ROBINSON (1999) placed three species in the genus.

Distribution: Angola, Congo, Malawi, Zambia.

### Genera of Eastern Hemisphere Vernonieae Subtribe Elephantopinae LESS. (1830)

Herbs. Involucre decussate with 4, 6 or 8 bracts; florets 4, corollas often zygomorphic; apical anther appendage thin, glabrous. Achene raphids elongate.

Four genera are placed in the subtribe, two of which occur in Africa, viz., *Elephantopus* L. and *Pseudelephantopus* ROHR.

*Elephantopus* L. Sp. Pl.: 814 (1753) & Gen. Pl., ed. 5: 355 (1754). Type: *E. scaber* L. (India).

The genus is distinguished by having alternate leaves and pappus of 5 to many straight bristles; cypsela with several twin hairs and idioblasts but without glands; endothelial cells intermediate;  $n = 11$ .

The African species of *Elephantopus* were revised by PHILIPSON (1938), the East African ones by JEFFREY (1988) and the West African ones by ISAWUMI (1999). About twelve species are credited to the genus world-wide while five of them occur in Africa (JEFFREY 1988).

Distribution: West, East and Central Africa, Southern Africa, pantropical.

*Pseudelephantopus* ROHR corr. C. F. BAKER in Trans. St. Louis Acad. Sci. 12: 55. 1902, nom. cons. *Pseudelephantopus* ROHR in Skr. Naturhist.-Selsk. 2(1): 214. (1792), nom. invalid. Type: *P. spicatus* (AUBL.) C. F. BAKER in Trans. St. Louis Acad. Sci. 12: 45. 1902.

Pappus with the bristles flexed or twisted, cypsela with twin hairs and capitate glands but without idioblasts;  $n = 13$  (JEFFREY 1988).

Two species are credited to tropical America, and one species to Africa.

Distribution: Native of the Neotropics, introduced to West & East tropical Africa and tropical Asia.

### **Genera of Eastern Hemisphere Vernoniae Subtribe Vernoniinae CASS. ex DUMORT. (1829)**

The majority of the genera of subtribe Vernoniinae are found in Western Hemisphere, including *Vernonia* SCHREB. Just a few of them occur in Eastern Hemisphere, viz *Manyonia* H. ROB. and *Sparganophoros* VAILL.

Herbs, weak shrubs or vines. Inflorescence often seriate- or scorpioid-cymose; inner involucreal bracts usually persistent. Anther appendages thin-walled, often with glands or hairs. Pollen mostly tricolporate, lophate or non-lophate.

*Manyonia* H. ROB. in Proc. Biol. Soc. Wash., 112 : 224. 1999. Type: *Vernonia peculiaris* VERDC. in Kew Bull. 1956: 447. 1956.

Only one species was placed in the genus by ROBINSON (1999). Distribution: Tanzania.

*Sparganophoros* VAILL. in Königl. Akad. Wiss. Paris Phys. Abh. 5: 368. 1754; BOEHM. in LUDWIG, Defin. Gen. Pl. ed. Boehm.: 154 (sphalm. '*Sparganophorus*') 560. 1760. Type: *S. vaillantii* CRANTZ (India).

Only one species has been placed in the genus.

*Sparganophoros sparganophora* (L.) C. JEFFREY in Kew Bull. 43: 272. 1988.

Synonymy: *Ethulia sparganophora* L., Sp. Pl. ed. 2: 1171. 1763. *Struchium sparganophorum* (L.) O. KUNTZE in Revis. Gen. Pl. 1: 366. 1891.

Distribution: West and East Africa, Madagascar, moist tropics of Malaysia, South India, Sri Lanka, New World, pantropical and widely adventive.

*Vernonia* SCHREB., Gen. 2: 541. 1791, nom. cons. Type: *Vernonia noveboracensis* (L.) WILLD. (North America).

The new genera and species hitherto elevated to generic rank are those that seem inescapable (ROBINSON 1999) and the remaining elements in *Vernonia* of the Eastern Hemisphere that do not fit in the genera presently recognized will hopefully be disposed of in future studies. The remaining elements in the Eastern Hemisphere *Vernonia* will be transferred to other genera because it appears that

the genus *Vernonia* will be restricted to the Western Hemisphere. About 59 taxa remain in African *Vernonia* as follows: *Vernonia aurantiaca* (O. HOFFM.) N. E. BR., *V. holstii* O. HOFFM., *V. ruvungatundu* C. JEFFREY, *V. kigomae* C. JEFFREY, *V. tricholoba* C. JEFFREY, *V. pteropoda* OLIV. & HIERN, *V. mixiodes* O. HOFFM. & MUSCHL., *V. bruceae* C. JEFFREY, *V. stuhlmannii* O. HOFFM., *V. fischeri* O. HOFFM., *V. biafrae* OLIV. & HIERN var. *biafrae*, *V. biafrae* OLIV. & HIERN var. *tufnelliae* (S. MOORE) ISAWUMI, *V. angulifolia* DC., *V. syringifolia* O. HOFFM., *V. subscandens* R. E. FR., *V. brachycalyx* O. HOFFM., *V. suprafastigiata* KLATT, *V. brachytrichoides* C. JEFFREY, *V. turbinata* OLIV. & HIERN, *V. homilantha* S. MOORE, *V. vollesenii* ("vollensenii") C. JEFFREY, *V. mikumiensis* C. JEFFREY, *V. natalensis* SCH. ex WALP., *V. alticola* G. V. POPE, *V. wollastonii* S. MOORE, *V. hochstetteri* SCH. BIP. ex WALP., *V. muelleri* WILD, *V. roseoviolacea* DE WILD., *V. wakefieldii* OLIV., *V. kandtii* MUSCHL., *V. amblyolepis* BAK., *V. schweinfurthii* OLIV. & HIERN, *V. luembensis* DE WILD. & MUSCHL., *V. mbalensis* G. V. POPE, *V. rhodanthoidea* MUSCHL., *V. amoena* S. MOORE, *V. nyassae* OLIV., *V. schliebenii* MATTF., *V. popeana* C. JEFFREY, *V. tinctosetosa* C. JEFFREY, *V. plumbaginifolia* FENZL ex OLIV. & HIERN, *V. violaceopapposa* DE WILD., *V. parapetersii* C. JEFFREY, *V. violacea* OLIV. & HIERN, *V. miombicola* H. WILD, *V. miombicoloides* C. JEFFREY, *V. acuminatissima* S. MOORE, *V. melanocoma* C. JEFFREY, *V. abbotiana* O. HOFFM., *V. afromontana* R.E. FR. var. *pleiocephala* CHIOV., *V. alboviolacea* MUSCHL., *V. eminii* O. HOFFM., *V. teitensis* O. HOFFM., *V. bauchiensis* HUTCH. & DALZ., *V. djalonenensis* A. CHEV., *V. jaegeri* C. D. ADAMS, *V. nimbaensis* C. D. ADAMS, *V. chapmanii* C. D. ADAMS, *V. andohii* C. D. ADAMS, *V. mokaensis* MILDBR. & MATTF.

### Conclusion

The present trend in the tribe Vernonieae has been work towards a full generic revision of the tribe with description of new genera and restoration of some older genera that had been placed in synonymy. Much work has been done with the generic revision of the Neotropical members of the tribe with more work still expected to be done on Paletropical taxa. ROBINSON (1996) recognized 111 genera in the tribe worldwide, while in this study about 35 genera are recognized for Africa.

ROBINSON et al. (1980) recognized eight subtribes in the subtribal classification of the Vernonieae worldwide. BREMER (1994) omitted the two monotypic subtribes of ROBINSON et al. (1980) which are Pseudostiffiinae and Trichospirinae. Later ROBINSON (1996) recognized seven subtribes omitting Pseudostiffiinae. All the subtribes are related to the Vernonieae in the Western Hemisphere. ROBINSON (1999) described three new subtribes for Eastern Hemisphere Vernonieae and

they are Erlangeinae, Centrapalinae and Gymnantheminae. Recently ROBINSON (2007) recognized 118 genera in 15 subtribes. The number of subtribes and genera are likely to increase with further studies especially on the Eastern Hemisphere members of the tribe.

Vernoniae are believed to have originated in the Eastern Hemisphere where the most divergent elements of the tribe, yellow-flowered and trinervate leaved *Distephanus* occur (BREMER 1994). The Tropics are believed to be the origin of the tribe, since that is the centre of diversity, the area where its primitive species occur, and the region in which the majority of its genera are located (JONES 1977, ISAWUMI 1999, ROBINSON 1996). According to JONES (1977), 19 endemic genera are found in Africa, and four in Madagascar. ROBINSON (2007) accounts for 28 genera endemic to Africa and five genera restricted to Madagascar. The Eastern Hemisphere is also the area where almost all the Vernoniae with  $x = 9$  or 10 occur. The higher chromosome numbers found in the Western Hemisphere Vernoniae follow the pattern of higher numbers in members of group invading new geographical areas (ROBINSON 1996).

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